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REMARKS

This is a full and timely response to the final Official Action mailed December 5, 2006. Reconsideration of the application in light of the following remarks is respectfully requested.

Claim Status:

Claims 18-20 and 26-30 were withdrawn under a previous Restriction Requirement and subsequently cancelled without prejudice or disclaimer. Claims 1-17, 21-25 and 31-38 are currently pending for further action.

Applicant proposes to amend claim 11 herein to correct a minor typographical error. This amendment does not raise new issues requiring further search or consideration and places the application in better form for allowance or appeal. Therefore, entry of the present amendment is proper under 37 C.F.R. § 116 and is hereby requested.

Prior Art:

Claims 1, 2, 4-11, 14, 15 and 36 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of U.S. Patent No. 6,838,035 to Ederer et al. ("Ederer") and U.S. Patent No. 6,405,095 to Jang et al. ("Jang"). For at least the following reasons, this rejection is respectfully traversed.

Claim 1 recites:

A stereolithographic method of forming three-dimensional structure comprising:

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- a) *ejecting drops of first and second different liquefied materials in a pattern and allowing the drops to solidify to form a layer of a three-dimensional object*, wherein the second liquefied material is deposited to form portions of the layers which define an external surface of the three-dimensional object;
  - b) surrounding the layer with a viscous liquid and controlling the level of the viscous liquid to be essentially level with the uppermost level of the portion of the layer formed from the drops of liquefied material;
  - c) *ejecting drops of the first and second liquefied materials in a pattern and allowing the drops to solidify and form another layer of the three-dimensional object*;
  - d) raising the level of the viscous liquid to a level proximate the uppermost level of the newly formed layer; and
  - e) repeating steps c) and d).
- (Emphasis added).

In contrast, Ederer and Jang fail to teach or suggest a method that includes ejecting drops of first and second different *liquefied* materials in a pattern and allowing the drops to solidify so as to form a layer of a three-dimensional object, wherein the second liquefied material is deposited to form portions of the layers which define an external surface of the three-dimensional object. For at least these reasons, the rejection of claim 1 based on Ederer and Jang should be reconsidered and withdrawn.

The final Office Action concedes that "Ederer does not teach a first and second different deposited liquid [materials] where the second liquid forms an external surface." (Action of 12/5/06, p. 4). Consequently, the Action proposes to combine the teachings of Ederer with those of Jang. However, Jang also fails to teach or suggest a method that includes ejecting drops of first and second different *liquefied* materials in a pattern and allowing the drops to solidify to form *a layer* of a three-dimensional object.

Jang teaches using a powdered, not a liquefied, material to form a weld pool that creates the bulk of an object layer. Specifically, Jung teaches "a heat-affected zone on the work surface ... for creating a weld pool of molten materials on this work surface by injecting selected powder particles into this heat-affected zone." (Jung, abstract). Jung then teaches a single liquid material deposited in peripheral areas. "Preferably, the peripheral areas and the

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staircase step zones between layers are built with fine droplets for improved part accuracy while the bulk of the object is built with solidification of weld pool materials." (*Id.*).

Jang does mention the possibility of using a second liquid material as a *support* material, but not as part of a layer of a three-dimensional object. "At least one device or channel is employed to deposit droplets of an object-building material while a second device is used for depositing a *support* structure." (Jung, col. 7, lines 25-28) (Emphasis added).

The final Office Action has failed to cite any portion of Ederer or Jang that teaches or suggests the claimed subject matter of using two different *liquefied* materials to form portions of an object, specifically "ejecting drops of first and second different liquefied materials in a pattern and allowing the drops to solidify to form a layer of a three-dimensional object."

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). For at least this reason, the rejection of claim 1 should be reconsidered and withdrawn.

Additionally, as Applicant pointed out previously, Ederer and Jung are two very different and incompatible systems that work on different principles. Ederer does not use a powdered build material and subsequent weld pool to build bulk portions of an object. Ederer teaches depositing a liquid build material into a fluid support bath. (Ederer, abstract). Clearly, a powdered build material that is heated into a weld pool could not be used in the context of the fluid support bath taught by Ederer.

Consequently, it is entirely unclear how or why it would have been obvious to one of skill in the art to combine the teachings of Ederer and Jung as proposed by the final Office Action. It is not enough to merely note that both references relate to rapid prototyping.

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(Action of 12/5/06, p. 5). Teachings can be in a single field and still be entirely incompatible approaches that cannot be readily combined in any meaningful way.

The final Office Action fails to address the wide discrepancy between the teachings of Ederer and Jung so as to reasonably explain the proposed combination of their teachings. The Office may wish to note the case law on this point. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)." M.P.E.P. § 2143.01. For at least these reasons, the rejection of Ederer and Jung is improper and the resulting rejection should be reconsidered and withdrawn.

Claim 2 recites "wherein the first material comprises resin." Applicant notes that, per claim 1, it is the second liquefied material that forms the external surface of the object. Thus, claim 2 recites that the internal or "first" build material comprises resin.

The final Office Action concedes that Ederer does not teach this subject matter (Action of 12/5/06, p. 4) and so cites to Jung at columns 13 and 14. (*Id.*). However, this portion of Jung is discussing the liquid material which Jung uses for "peripheral areas and the staircase step zones between layers" or for a support structure. As explained above, Jung teaches that an internal build material is a powder that is melted in a weld pool.

Thus, the Office's citations to Jung do not teach or suggest the claimed "first" or internal build material comprising a resin. Moreover, this rejection again raises the questions of why it would have been obvious to take a resin taught by Jung and combine it into the entirely different fabrication system taught by Ederer. For at least these reasons, the rejection of claim 2 should also be reconsidered and withdrawn.

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Claim 5 recites "wherein the second material *and* the first material comprise metal." (Emphasis added). In contrast, the final Office Action fails to address claim 5 or explain how or where the cited prior art teaches depositing two liquefied metals, one to form an exterior surface, in a stereolithographic method of forming an object. For at least this additional reason, the rejection of claim 5 should be reconsidered and withdrawn.

Claim 6 recites "further comprising the step of heating the three-dimensional object to a degree sufficient to soften the second material and induce it to flow into voids formed between solidified drops of the first material." In this regard, the Office Action cites Jung as teaching "heating a second *deposited* material to a molten state." (Action of 12/5/06, p. 5) (emphasis added). However, the portions of Jung cited only refer to a material being liquid or liquefied *for deposition*. The Office fails to cite any portion of Jung that actually teaches heating the object, or the material *after deposition* sufficient to cause the second (or exterior) material to flow into voids formed between solidified drops of a first (or interior) material. This subject matter is nowhere taught or suggested by the prior art of record. For at least this additional reason, the rejection of claim 6 should be reconsidered and withdrawn.

Claim 7 recites "further comprising the step of heating the three-dimensional object to a degree sufficient to alloy the solidified drops of the first and second materials." The final Office Action utterly fails to indicate how or where the cited prior art teaches heating a fabricated object to alloy adjacent solidified drops of a first and second metal. For at least this additional reason, the rejection of claim 7 should be reconsidered and withdrawn.

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Claim 8 recites "using a thermoplastic resin as the first liquefied material; and using metal as the second material." In contrast, the final Office Action fails to indicate how or where the cited prior art teaches or suggest the combination of a thermoplastic resin and a metal in forming a three-dimensional object as claimed.

Claims 12, 13, 16, 17 and 37 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ederer, Jang and U.S. Patent No. 5,510,066 to Fink et al. ("Fink"). This rejection is respectfully traversed for at least the same reasons given above with respect to claim 1 and for the following additional reasons.

Claim 17 recites "wherein at least the viscous material which has entered the voids is hardened to increase smoothness of the external surface of the three-dimensional object." The final Office Action overlooks that this viscous material is also the support material into which the liquefied build materials are originally deposited. In contrast, the cited prior art does not teach or suggest the claimed method in which a viscous material surrounds layers of an object being formed, enters voids formed between solidified drops of the build material and is then hardened in the voids to increase smoothness of the object. The final Office Action utterly fails to make out a *prima facie* case that such subject matter is suggested by the prior art of record. For at least this additional reason, the rejection of claim 17 should not be maintained.

Claim 37 recites "wherein the impregnation material comprises a resin." Again, this impregnation material that comprises a resin is also, per claim 1, the viscous support material into which the liquefied build materials are deposited. In contrast, the cited prior art does not teach or suggest the subject matter of claim 37, nor does the final Office Action indicate how

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or where this is the case. For at least these additional reasons, the rejection of claim 37 should not be maintained.

Claim 3 was rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ederer, Jang and U.S. Patent 5,301,425 to Prinz et al. ("Prinz"). This rejection is respectfully traversed for at least the same reasons given above with respect to claim 1 and for the following additional reasons.

Claim 3 recites "wherein the second material has a melting point which is different from the melting point of the first material." Applicant notes that both the first and second materials are used to form a layer of the object being fabricated. In contrast, the Office Action concedes that Ederer and Jang fail to teach or suggest the subject matter of claim 3. (Action of 12/5/06, p. 7). Consequently, the Action cites to Prinz. However, Prinz does not teach or suggest two build materials with different melting points, as in claim 3. Rather, Prinz teaches a *support* material that is *removed* from the object with a lower melting point than the build material. According to Prinz, "after the final layer has been applied, the complementary material is removed leaving the created object. We prefer to use a complementary material having a lower melting point than the deposition material." (Prinz, col. 4, lines 18-23).

Thus, Prinz has nothing to do with the subject matter of claim 3. For at least this additional reason, the rejection of claim 3 should be reconsidered and withdrawn.

Claim 38 was rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ederer, Jang and U.S. Patent No. 6,579,479 to Edie et al. ("Edie"). This

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rejection is respectfully traversed for at least the same reasons given above with respect to claim 1 and for the following additional reasons.

Claim 38 recites "wherein said first and second materials comprise silver and tin solder respectively." Per claim 1, the second material, i.e., tin, is specifically deposited in a pattern to form portions of the object layer that define an external surface of the object. In contrast, Edie, according to the Office Action, merely teaches "silver and tin in a solder mixture." (Action of 12/5/06, p. 8).

Consequently, Edie cannot teach or suggest the subject matter of claim 38 in combination with Ederer and Jang as proposed in the Office Action. For at least this additional reason, the rejection of claim 38 should not be maintained.

Claims 21, 25 and 31-35 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ederer and Fink. For at least the following reasons, this rejection is respectfully traversed.

Claim 21 recites:

A method of forming a three-dimensional object comprising:  
ejecting drops of liquefied material into a vat using an ejector;  
scanning the ejector in first and second mutually opposed directions to deposit and solidify said drops in a predetermined pattern to sequentially form layers of the three-dimensional object;

supplying a viscous liquid into the vat to a level which is essentially level with the top of a most recently formed layer of the three-dimensional object, *wherein said viscous liquid both supports the material being formed into a three-dimensional object and fills in voids between drops of the material forming the three-dimensional object*; and

*removing the object from the viscous liquid in the vat and then solidifying the viscous liquid remaining in the voids between solidified drops of the material forming the object.*

(Emphasis added).



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The final Office Action concedes that Ederer does not teach removing the object from the viscous liquid in which it was formed and then solidifying the liquid remaining in the voids between the solidified drops of the material forming the object. (Action of 12/5/06, p. 9). Consequently, the Office Action cites to Fink. However, Fink also fails to teach or suggest this subject matter.

In the first place, Fink does not teach or suggest a method in which an object is formed in a vat of viscous liquid. Consequently, it is impossible for Fink to teach solidifying the residue of such a liquid after the object has been removed from the vat to fill voids between solidified drops of the material forming the object.

Fink teaches a process of "firing" an object that was formed without using a vat of viscous support liquid in order to improve the strength of the finished object. (Fink, col. 11, lines 42-54). This, however, clearly has nothing to do with the claimed subject matter of solidifying a liquid residue from a vat of support liquid that has entered voids between solidified drops of the material forming the object. It is entirely unclear how the Office Action can consider Fink relevant to the subject matter of claim 21.

Thus, the combination of Ederer and Fink utterly fails to teach or suggest removing a fabricated object from a viscous support liquid in a vat and then solidifying a residue of that same viscous support liquid that remains in the voids between solidified drops of the material forming the object. "To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). For at least these reasons, the rejection of claim 21 should be reconsidered and withdrawn.

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Claim 35 recites "wherein solidifying the viscous liquid remaining in the voids further comprises polymerizing the viscous liquid remaining in the voids." In contrast, this subject matter is not taught or suggested by the prior art of record for at least the reasons given above with respect to claim 21. Therefore, this rejection should also be reconsidered and withdrawn.

Claims 22-24 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Ederer, Fink and Jang. This rejection is respectfully traversed for at least the same reasons given above with respect to claim 21 and for the following additional reasons.

Claim 22 recites "wherein the step of ejecting comprises ejecting drops of first and second materials and controlling the drops of the second material to form a predetermined portion of the layer with respect to a portion of the layer which is formed of the drops of the first material." The final Office Action relies on Jang for this subject matter. (Action of 12/5/06, p. 10). However, as demonstrated above, Jang does not teach or suggest two liquid materials that are ejected as drops and that form portions of an object layer. For at least this additional reason, the rejection of claim 22 should not be maintained.

The rejection of claim 24 is traversed for the same reasons given above with respect to claim 7.

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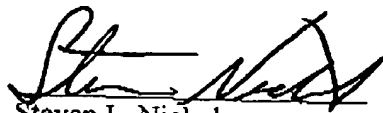
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Conclusion:

For the foregoing reasons, the present application is thought to be clearly in condition for allowance. Accordingly, favorable reconsideration of the application in light of these remarks is courteously solicited. If the Examiner has any comments or suggestions which could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the number listed below.

Respectfully submitted,

DATE: January 26, 2007

  
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